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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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STAAS & HALSEY LLP SUITE 700 1201 NEW YORK AVENUE, N.W. WASHINGTON, DC 20005			EXAMINER THAKUR, VIREN A	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/500,448

Applicant(s)

WAKAMURA, MASATO

Examiner

VIREN THAKUR

Art Unit

1782

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 June 2010.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 15, 17-19 and 26-32 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 15, 17-19 and 26-32 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 30 June 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB-08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ ~~Notice of Informal Patent Application~~
- 6) ☐ Other: _____

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on June 29, 2010 has been entered.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. **Claims 15,17-19,23-32 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.**

Claims 15,17-19 and 26-32 recite the limitation "enhancing photocatalytic activity." This limitation is not clear as to how the activity is enhanced or compared to what is the activity enhanced.

Claims 29-32 recite the limitation "wherein the storage of the food is performed without ultraviolet irradiation." It is noted that the limitation "the storage" has antecedent basis to the limitation "for storage" as recited in claims 15, 17, 18 and 19. Therefore,

the independent claims from which claims 29-32 depend are missing the positive recitation of the step of storing the food. Furthermore, regarding the limitation "without ultraviolet irradiation," in light of the specification this limitation is not clear as to whether "without ultraviolet irradiation" means without visible light or whether "without ultraviolet irradiation" means that there is was an additional ultraviolet irradiation step that has been eliminated.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

6. Claims 15, 17, 29 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dunn (US 5658530) in view of Wakamura (JP2000-327315), Mawatari et al. (US 5614568), Saito (JP03-275627), Kato (JP07-100378), Imura et al. (WO0046153), Taoda et al. (US 5981425) and Bontinck et al. (US 4367312) and in

further view of Wakamura (JP2001-302220) and Shimazaki (JP63023744) and in further view of Sakurada et al. (US 6004667) and Sakurada et al. (JP11343210).

Regarding claim 15, Dunn teaches a method for deactivating biological contaminants and chemical contaminants on the surface of a perishable food product or on the packaging material by passing light through the package (Column 2, Lines 49-61; Column 3, Lines 34-41). The surface of the packaging material or food product is supplemented with titanium dioxide, which when illuminated at specific light frequencies will deactivate contaminants within the package or on the surface of the food product (Column 3, Lines 14-23; Column 4, Lines 59-62). Thus, Dunn teaches applying the anti-microbial composition to the food itself or to the packaging containing the food. Dunn further teaches the inner surface of the container comprises the titanium dioxide (Column 11, Line 58 to Column 12, Line 30). Dunn teaches applying a photocatalytic material to food containers or directly to foods.

Regarding claim 15, Dunn is silent in teaching the use of Ti modified calcium hydroxyapatite and bringing food into contact with the Ti-modified calcium hydroxyapatite.

Wakamura et al. '315 teaches that titanium oxide has been well known be an antimicrobial agent (Paragraph 0002). Wakamura et al. '315 further teach that titanium oxide does not have the properties for adsorbing matter, such as microorganisms on its face, and limited oxidative degradation of such microorganisms is achieved using titanium oxide, alone (Paragraph 0002). Wakamura et al. '315 teach that titanium oxide films have limited oxidative degradation function when used on its own and calcium

phosphate compounds such as hydroxyapatite tends to lose its adsorption power when adsorption equilibrium is reached (Paragraph 0006). Wakamura et al.'315 further teaches replacing part of Ca with Ti (Paragraph 0010). The invention of Wakamura et al. '315 teach a combination of the photocatalyst activity of titanium with the adsorption activity of hydroxyapatite that maintains the adsorption power of the calcium phosphate while maintaining the oxidative disassembling properties of the photocatalyst (Paragraph 0002; Paragraph 0006; Paragraph 0007). Wakamura et al. '315 further teach that the metal modified hydroxyapatite can be applied to several "configurations" such as a sheet, a film, a plate, a particle and a tablet (Paragraph 0017). Wakamura et al. '315 teach that the sheet or film can be used to cover one or both sides of a base material (Paragraph 0017). Since Wakamura '315 teaches the advantage of the using Ti-modified calcium hydroxyapatite over only using titanium, to substitute the antimicrobial agent used in Dunn with the titanium modified calcium hydroxyapatite taught by Wakamura et al. '315 would have been obvious to one having ordinary skill in the art for the purpose of improving obtaining both the photocatalytic activity of the titanium with the adsorption activity the calcium hydroxyapatite. Although Dunn already teaches applying an antibacterial agent to food containers and bringing into contact with food, Mawatari et al. has been cited as further evidence that it has been conventional in the art to employ a metal modified calcium hydroxyapatite (column 5, lines 3-6 and column 7, lines 22-49) to articles that come into contact with food, such as kitchenware (column 1, line 17), for its antibacterial properties. Mawatari et al. further teach that by supporting the metal ions on the porous substance, the porous structured substance

have been subjected to ion-exchange with the metal ions (Column 4, Line 62 to Column 5, Line 2). As a result, the metal supported on the substrate would not be dissolved out by water treatment (Column 7, Lines 43-47) and thus can be applied to the molded article such as the polymeric resin at any amount (Column 7, Lines 47-49). Mawatari et al. also teaches that the metal modified hydroxyapatite can be employed in food contact applications such as kitchenware. Therefore, it would have been obvious to one having ordinary skill in the art to employ a titanium modified calcium hydroxyapatite, since the art teaches that such a combination solves the problem of providing satisfactory antibacterial and photocatalytic activity to containers.

Claim 15 differs from the above combination in reciting that the titanium modified calcium hydroxyapatite has been sintered at 580-660°C for enhancing photocatalytic activity. It is noted that the claims do not specify how the photocatalytic activity has been enhanced, or compared to what has the photocatalytic activity been enhanced.

It is noted however, that Saito teaches replacing the metal ion on apatite with an antimicrobial metal and then employing an ion-exchange method to produce a metal modified hydroxyapatite (see page 4 of the formal translation). After filtering and then drying at 110°C for 4 hours, Saito teaches heating the combination at 600°C (see page 5, lines 11-16 of the formal translation and example 2). The resulting product has potent antimicrobial activity, is resistant to heat and chemicals and retains its antimicrobial activity when mixed with resins (see page 2 "Problems to be solved by the invention"). The heating at 600°C falls within applicants' claimed range, and further results in rigidly fixing the metal ions with the hydroxyapatite so as to prevent the metal

ions from readily dissolving out (see page 5, 11-16 of the translation). On page 4 of the formal translation, Saito also teaches that various antimicrobial metals can be employed, such as silver, copper, zinc, tin, mercury, lead, cadmium to name a few. It is noted that Wakamura '315 teaches using various antimicrobial metals, such as titanium, zirconium or zinc (paragraph 0005) and copper and aluminum (see paragraph 0012). Therefore, an overlap exists between the particular metals employed by Saito and Wakamura '315, such as copper and zinc. It is even noted that zirconium, taught by Wakamura '315 is in the same group as titanium on the periodic table.

Therefore the metals taught by Wakamura '315 and Saito, who teaches sintering at 600°C, are similar in that they are all antimicrobial acting metals. In addition, both silver and titanium have the similar property of being antimicrobial as well as oxidizing.

Additionally, Saito and the above combination are similar in that they employ metal modified calcium hydroxyapatite for the purpose of providing antimicrobial properties when applied to articles. The art has also recognized the advantage of sintering to within applicants' claimed range, for the purpose of preventing the metal from dissolving out and for providing antimicrobial and photocatalytic activity. To thus modify the combination of Dunn and Wakamura '315 and heat the titanium modified calcium hydroxyapatite to 600°C as taught by Saito would have been obvious to one having ordinary skill in the art, since Saito teaches that heating of a metal modified calcium hydroxyapatite results in improved fixing of the metal onto the hydroxyapatite thus preventing the metal from dissolving out. Since Saito already provides motivation for heating to 600°C, the result of such a heating step, of enhanced photocatalytic

activity would also have been intrinsic to the Ti-modified calcium hydroxyapatite when heated for the purpose of improving the rigidity of the substance. This would further have been the case since the claim does not specify how the photocatalytic activity has been enhanced. It is even noted that Wakamura et al. '315 evidences that when employing a sol-gel method, similar to applicants' method for making metal modified hydroxyapatite, that sintering temperatures in the "vicinity" of 500°C (see paragraph 0013 of the formal translation) results in achieving a crystal structure of photocatalytic activity. Wakamura '220 has been relied on as further evidence of the use of the sol-gel method. Additionally, it is noted that the art has recognized employing heating temperatures at 600°C and even 630°C, for instance, for the purpose of producing a titanium crystal structure that would achieve the desired photocatalytic activity, as evidenced on paragraphs 0007 and 0013 of Kato. Imura et al. even teaches that heating titanium oxides that the step of heating to between 300-700°C for the purpose of achieving the desired photocatalytic activity (see paragraphs 0003-0011). Taoda et al. even teaches that calcination of a titanium coated substrate at 600°C increases the photocatalyst activity of the titanium (see column 3, lines 56-67). Therefore, these teachings fairly lead one of ordinary skill in the art to employ such temperatures for achieving a particular degree of photocatalytic activity of photocatalytic titanium. Therefore, if the ordinarily skilled artisan desired to achieve a particular degree of photocatalytic activity, the art teaches heating to within applicants claimed range. To thus heat a titanium modified hydroxyapatite to within applicants' claimed range would thus have been routinely determinable through experimentation for achieving a

particular degree of photocatalytic activity to the titanium. This would especially have been the case since the titanium on its own has photocatalytic activity and since the titanium when modifying calcium hydroxyapatite still has this same photocatalytic activity.

It is noted that Mawatari et al. also teaches sintering/heating metal modified calcium hydroxyapatite for the purpose of ensuring that the bond between the metal (i.e. antibacterial agent) and the calcium hydroxyapatite is further stabilized and strengthened (column 7, lines 40-49). Such treatment ensures that the antibacterial metal component is not dissolved out by any water treatment and therefore allows the metal modified calcium hydroxyapatite to be mixed in any desired amount with additional components, such as a styrene resin (which can be used to make containers and the such). It is further noted that Mawatari et al. also teach that the particular antibacterial metal can be selected from a broad range and can include metals such as silver, zinc, iron, lead and nickel (column 5, lines 3-9). Bontinck et al. is cited as further evidence that it was conventional in the art to employ styrene resins (See Abstract) for protecting foodstuffs, pharmaceuticals, cosmetics, toys, tools and similar articles, such as surgical instruments (Column 1, Lines 13-17). Bontinck et al. further teach packages of food products such as biscuits using the packaging film (Column 13, Lines 34-43). This is similar to Mawatari who teaches that metal modified hydroxyapatites can be applied to various substrates, such as styrene packaging, for providing antimicrobial activity.

Shimazaki have been relied on as further evidence of heat sintering metal modified hydroxyapatites for achieving the desired antimicrobial properties. Shimazaki teaches high catalytic activity of a metal modified calcium hydroxyapatite, which can be modified by metals such as titanium, zirconium, tungsten (see page 3 of formal translation, above detailed description and page 7 and page 9-10 "partially-substituted calcium hydroxyapatite"). Shimazaki teaches sintering for the purpose of improving the catalytic activity of metal modified calcium hydroxyapatite (see page 13, "The inventive catalyst..."), using metals such as titanium, zirconium and tungsten (page 15), which also overlap those metals discussed above. Shimazaki also teaches on page 11, lines 16-20 of the formal translation, that the catalyst can be fired between 400-800°C with partial substitution of the hydroxyapatite with metal (page 14) and wherein the metal modified hydroxyapatite can be fired at 600°C (page 24 and 26). Shimazaki provides numerous examples of employing heating after forming the metal modified hydroxyapatite at temperatures of 500°C and 600°C.

Claim 15 further recites that the food is brought into contact with the titanium modified hydroxyapatite by placing food in a container that has been coated with the sintered titanium modified apatite.

Regarding this limitation, it is noted that Dunn already teaches putting food into a container that is coated with an antibacterial agent. Nevertheless, it would have been obvious to have substituted the titanium taught by Dunn for the titanium modified calcium hydroxyapatite, as taught by Wakamura '315 for the purpose of achieving the combined photocatalytic effects of the titanium with the absorption properties of the

apatite. It is noted that Mawatari et al. already teach metal modified apatite employed for their antimicrobial functions, and which have been coated on containers such as for kitchenware, as discussed above. This reasonably teaches that metal modified hydroxyapatite can be employed in food contact applications. In any case, Bontinck et al. is cited as further reference that it was conventional in the art to employ styrene resins (See Abstract) for protecting foodstuffs, pharmaceuticals, cosmetics, toys, tools and similar articles, such as surgical instruments (Column 1, Lines 13-17). Bontinck et al. further teach packages of food products such as biscuits using the packaging film (Column 13, Lines 34-43). Sakurada et al. '667 has been cited as further evidence that it was conventional to combine the photocatalytic activity of titanium with the absorptive properties of calcium hydroxyapatite for the purpose of providing an antimicrobial food packaging film (Column 5, Lines 18-22; Column 6, Lines 10-14 and 55-63; Column 9, Lines 19-26; Column 10, Lines 49-65). Similarly, Sakurada '210 also teaches applying the combination of titanium and calcium hydroxyapatite to paper, cloth and plastics that can be used for food packaging (abstract) which prevent the spread of bacteria and minimize the need to carefully clean and wash articles that need to be sterile, since the coating prolongs the sterility of the article (paragraph 0003-0004). Since the art teaches the advantages of employing titanium modified calcium hydroxyapatite and further teaches that metal modified hydroxyapatites can be applied to food contact articles, the art fairly teaches one having ordinary skill in the art that once the art recognized the antibacterial advantages of employing titanium modified calcium hydroxyapatite and since the art teaches food contact applications of such modified hydroxyapatites, to thus

package food in such containers would have been obvious to one having ordinary skill in the art, for the purpose of preventing bacterial spoilage on the food.

Claim 17 is similar to claim 15 except that instead of a container, the food is wrapped in a wrapping film coated with the metal modified calcium hydroxyapatite. Wakamura et al. '315 also teach wherein the substrate can be a sheet or film (paragraph 0017, 0019 and 0020). Bontinck et al. further teach packages for food products such as biscuits using packaging film (Column 13, Lines 34-43). Nevertheless, once the art taught coating various food contact surfaces with a metal modified apatite, it would have been obvious to one having ordinary skill in the art to apply the titanium modified hydroxyapatite, as taught by the combination, to packaging films, for the purpose of preventing contamination of the foodstuffs and the pharmaceuticals that can be wrapped in the film. The art taken as a whole thus teaches that it was conventional to coat various food packaging articles with a titanium modified calcium hydroxyapatite for the purpose of protecting the contents therein. The particular conventional packaging material, such as a container or wrapping film, that the ordinarily skilled artisan would have chosen to apply the sintered titanium modified calcium hydroxyapatite would thus have been an obvious matter of choice and/or design depending on the particular product to be packaged and protected.

Claims 29 and 30 recite the limitation that "the storage of the food is performed without ultraviolet irradiation." Regarding this limitation, it is noted that the claim does not specify whether "without ultraviolet irradiation" also means without any type of light. It is noted that ultraviolet light would not appear to be present when storing foods within

a refrigerator or in a pantry. Nevertheless, it is noted that Dunn even teaches that *if* in light, then titanium metals can facilitate prevention of contamination by employing photocatalytic activity of the titanium. Nevertheless, since the combination already teaches using a combination of photocatalytic material and antimicrobial material, to thus store a food package having a coating of this material in a place without ultraviolet irradiation, such as a refrigerator would still have been obvious to one having ordinary skill in the art for the purpose of preventing contamination due to exposure to light.

7. Claims 18 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over the references as applied to claims 15, 17, 29, 30, above in paragraph 6, relying on Dunn as the primary reference, and in further view of Sakuma et al. (US 5468489).

Claim 18 differs from the combination as applied above in reciting applying the calcium hydroxyapatite to the surface of the food or adding the sintered titanium modified calcium hydroxyapatite to the food. It is noted that, Dunn teaches that the antibacterial agent can be applied to the food or to the food packaging. It is further noted that Sakuma et al. also teach sintered metal modified calcium hydroxyapatite which has been included into toothpaste (see abstract). Therefore the art taken as a whole teaches that it was conventional in the art to include titanium modified calcium hydroxyapatite and metal modified calcium hydroxyapatites to food and to thus add sintered titanium modified calcium hydroxyapatite to food would have been obvious to

one having ordinary skill in the art for the purpose of preventing the growth of bacteria on the food or in the food.

Claim 31 is similarly rejected for the reasons given above with respect to claims 29 and 30 in the rejection relying on Dunn as the primary reference.

8. Claims 26 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over the references as applied to claims 15, 17, 29 and 30 above, and in further view of Izawa (JP2000-17456).

Regarding claims 26 and 27, the combination as applied above teaches coating a container with a metal modified hydroxyapatite, as evidenced by Mawatari for instance. Claims 26 and 27 differ in reciting that the packaging material has been coated with a sol-gel solution containing a silica alkoxide and a powder of the metal modified hydroxyapatite.

It is noted however, that the use of silica alkoxide sol-gel solutions for coating surfaces has been a conventional technique for applying coatings. For instance Taoda et al. teaches a coating composition comprising photocatalytic activity, which includes a titanium oxide and a calcium phosphate (column 2, lines 42-43 and column 1, lines 5-10 and line 65 to column 2, line 4), and wherein the calcium phosphate can be a hydroxyapatite (column 4, lines 55 to column 5, line 7) and further teaches employing a metal alkoxide sol-gel, such a silica alkoxide sol-gel (column 7, lines 8-15) for preparing an inorganic coating (column 8, lines 11-15 and column 8, lines 36-57). Taoda et al. is similar to the combination applied above in that it teaches employing a combination of

titanium photocatalytic materials with hydroxyapatite antimicrobial materials and coating the combination on a substrate for achieving both antimicrobial and photocatalytic protection. It is noted that Taoda et al. even teaches that calcination of a titanium coated substrate at 600°C increases the photocatalyst activity of the titanium (see column 3, lines 56-67). Izawa teaches a similar process of employing a silica alkoxide sol-gel for the purpose of coating a metal and apatite combination (see abstract), for the purpose of providing an antimicrobial coating on the surface of articles such as tableware (see paragraph 0006, 0007, 0009 and 0015 of the machine translation). Izawa teaches that such a coating provides antimicrobial protection (paragraph 0011) and also results in a coating for tableware or containers that has excellent flexibility (paragraph 0030 of the machine translation). Thus, to modify the combination and employ a silica alkoxide sol-gel process for coating a titanium modified hydroxyapatite powder to the surface of a container would have been obvious to the ordinarily skilled artisan as a conventional expedient for coating container and food contact surfaces, which provides protection against microorganisms as well as photo-degradation.

9. Claims 29 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over the references as applied above to claims 15, 17, 29 and 30, above and in further view of Farnham (US 2531329) and Salvi (US 6632467).

Regarding claims 29 and 30, if applicants' intent was to store food without light, then it is noted that Farnham teaches storage of a food product in a container teaches

storage when exposed to sunlight and storage in darkness to minimize the effect of ultraviolet light (see column 4, lines 54-60). Salvi further evidences this concept on column 16, lines 53-59). Therefore, to modify the combination and store the food without exposure to ultraviolet light would thus have been obvious to one having ordinary skill in the art, for the purpose of preventing ultraviolet radiation from resulting in contamination or spoilage of the product.

10. Claims 19 and 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over the references as applied to claims 15, 17, 29 and 30, above in paragraph 6, and in further view of Okamoto (JP 2000-051041).

Claim 19 recites bringing the food into contact with tableware surface coated with sintered titanium modified calcium hydroxyapatite. It is not clear as to whether the kitchenware taught by Mawatari can be considered tableware. Nevertheless, Okamoto teaches tableware, such as a drinking cup that comprises a photocatalyst for the purpose of removing odor and dirt from the inner portions of the tableware. Thus, Okamoto teaches providing similar photocatalytic activity to the surfaces of tableware for the purpose of preventing dirt and odors that collect on the inner surface from affecting the taste of the food. In addition, Mawatari et al. teaches coating kitchenware with sintered metal modified calcium hydroxyapatite for the similar purpose of preventing bacterial growth.

In view of the art taken as a whole, to therefore place food onto tableware or kitchenware that has also been coated with sintered titanium modified calcium hydroxyapatite would thus have been an obvious matter of choice and/or design, especially since the combination already teaches placing food into a container or wrapping food comprising sintered titanium modified calcium hydroxyapatite. As discussed above, once it was known in the art to coat kitchenware, containers and other articles with sintered titanium modified calcium hydroxyapatite, the particular article coated would have been an obvious matter of choice and/or design.

Claim 32 is similarly rejected for the reasons given above with respect to claims 29 and 30 in the rejection relying on Dunn as the primary reference.

11. Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over the references as applied to claim 19 above, and in further view of Izawa (JP2000-17456), for the reasons given above in paragraph 8.

12. Claim 31 is rejected under 35 U.S.C. 103(a) as being unpatentable over the references as applied above to claims 18 and 31 above, and in further view of Farnham (US 2531329) and Salvi (US 6632467), for the reasons given above with respect to claims 29 and 30, above in paragraph 9.

13. Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over the references as applied above to claims 19 and 32 above, and in further view of Farnham (US 2531329) and Salvi (US 6632467), for the reasons given above with respect to claims 29 and 30, above in paragraph 9.

14. Claims 15, 17, 29 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wakamura (JP 2000327315) in view of Saito (JP03275627), Kato (JP07-100378), Imura et al. (WO0046153), Taoda et al. (US 5981425), Wakamura (JP2001-302220), Shimazaki (JP63023744), and in further view of Dunn (US5658530), Mawatari et al. (US 5614568), Bontinck et al. (US 4367312), Sakurada et al. (US 6004667) and Sakurada et al. (JP11343210).

Regarding claim 15, Wakamura '315 teaches titanium modified calcium hydroxyapatite, which provides both the antimicrobial (photocatalytic) effects of the titanium in combination the adsorbing properties of calcium hydroxyapatite. Wakamura '315 teaches that this combination is improved over titanium alone which has limited photocatalytic (oxidation) functionality, by modifying calcium hydroxyapatite with a metal such as titanium. Wakamura '315 teaches a combination can absorb organic substances and also employ the antimicrobial / photocatalytic activity of the metal.

The claim differs from Wakamura '315 in specifically reciting sintering the titanium modified calcium hydroxyapatite at between 580°C to 660°C.

Saito, Kato and Imura et al., Taoda et al. and Wakamura '220 have been relied on as discussed above, to teach the advantages of heating a metal modified

hydroxyapatite to 600°C , for the purpose of preventing dissolution of the metal after drying and for increasing the photocatalytic activity. The art taken as a whole fairly teaches sintering a metal modified calcium hydroxyapatite for the purpose of improving its catalytic and/or antimicrobial activity and for preventing dissolution of the metal from the metal modified hydroxyapatite. Thus to employ temperatures of 600°C, for instance, would have been obvious to one having ordinary skill in the art, as an obvious result effective variable, routinely determined through experimentation for the purpose of achieving the desired degree of photocatalytic activity, as well as for preventing the metal from dissolving out of the metal-modified hydroxyapatite.

The claim further differs from the combination in bring food into contact with the sintered titanium modified calcium hydroxyapatite. It is noted that Dunn already teaches a container coated with an antimicrobial agent, such as titanium, into which food is placed (i.e. bringing food into contact with the antimicrobial agent), as discussed in the first rejection of claim 15, above. Since Wakamura '315 teaches improved properties of the titanium modified calcium hydroxyapatite, as discussed above over the photocatalytic/antimicrobial titanium alone, to coat a container for preserving food with the sintered titanium modified calcium hydroxyapatite as taught by the combination, would have been obvious to one having ordinary skill in the art, for the purpose of improving the antimicrobial activity of the coating used to preserve the food. It is noted that Mawatari et al., Bontinck et al., have been relied on as discussed above to teach that it was conventional to combine a metal such as silver or titanium with calcium

hydroxyapatite and coat containers and films into which food is placed, for the purpose of preserving the food.

Further regarding the step in claim 15 of placing food into a container coated with sintered titanium modified calcium hydroxyapatite, the combination, as applied above already teaches placing food into a container. Regarding claim 17, Mawatari et al. teaches kitchenware made from resins that comprise metal modified calcium hydroxyapatite, with the apatite coating employed for its antimicrobial properties. Bontinck et al. teaches that it was conventional in the art to employ resin materials for food packaging. Sakurada '210 and Sakurada '667 teach that it was conventional to combine the photocatalytic activity of titanium with the absorptive properties of calcium hydroxyapatite for the purpose of providing an antimicrobial food packaging film, as discussed in the rejection above. Once it was obvious to one having ordinary skill in the art to coat a container with a sintered titanium modified calcium hydroxyapatite material for the purpose of preserving the food placed therein, the particular conventional food packaging material to be coated and then into which food is placed would have been an obvious matter of choice and/or design.

Claims 29 and 30 are similarly rejected for the reasons given above in the rejection relying on Dunn as the primary reference.

15. Claims 18 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over the references as applied to claims 15, 17, 29, 30, above in paragraph 14,

relying on Wakamura '315 as the primary reference, and in further view of Sakuma et al. (US 5468489).

Claim 18 differs from the combination as applied above in reciting applying the calcium hydroxyapatite to the surface of the food or adding the sintered titanium modified calcium hydroxyapatite to the food. It is noted that, Dunn teaches that the antibacterial agent can be applied to the food or to the food packaging. It is further noted that Sakuma et al. also teach sintered metal modified calcium hydroxyapatite which has been included into toothpaste (see abstract). Therefore the art taken as a whole teaches that it was conventional in the art to include titanium modified calcium hydroxyapatite and metal modified calcium hydroxyapatites to food and to thus add sintered titanium modified calcium hydroxyapatite to food would have been obvious to one having ordinary skill in the art for the purpose of preventing the growth of bacteria on the food or in the food.

Claim 31 is similarly rejected for the reasons given above with respect to claim 31 in the rejection relying on Dunn as the primary reference.

16. Claims 19 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over the references as applied to claims 15, 17, 29, 30, above in paragraph 14, relying on Wakamura '315 as the primary reference, and in further view of Okamoto (JP 2000-051041).

Claim 19 recites bringing the food into contact with tableware surface coated with sintered titanium modified calcium hydroxyapatite. It is not clear as to whether the kitchenware taught by Mawatari can be considered tableware. Nevertheless, Okamoto teaches tableware, such as a drinking cup that comprises a photocatalyst for the purpose of removing odor and dirt from the inner portions of the tableware. Thus, Okamoto teaches providing similar photocatalytic activity to the surfaces of tableware for the purpose of preventing dirt and odors that collect on the inner surface from affecting the taste of the food. In addition, Mawatari et al. teaches coating kitchenware with sintered metal modified calcium hydroxyapatite for the similar purpose of preventing bacterial growth.

In view of the art taken as a whole, to therefore place food onto tableware or kitchenware that has also been coated with sintered titanium modified calcium hydroxyapatite would thus have been an obvious matter of choice and/or design, especially since the combination already teaches placing food into a container or wrapping food comprising sintered titanium modified calcium hydroxyapatite. As discussed above, once it was known in the art to coat kitchenware, containers and other articles with sintered titanium modified calcium hydroxyapatite, the particular article coated would have been an obvious matter of choice and/or design.

Claim 32 is similarly rejected for the reasons given above with respect to claim 32 in the rejection relying on Dunn as the primary reference.

17. Claims 26 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over the references as applied to claims 15, 17, 29 and 30 above in the reference relying on Wakamura '315 as the primary reference in paragraph 14, and in further view of Izawa (JP2000-17456).

Regarding claims 26 and 27, the combination as applied above teaches coating a container with a metal modified hydroxyapatite, as evidenced by Mawatari for instance. Claims 26 and 27 differ in reciting that the packaging material has been coated with a sol-gel solution containing a silica alkoxide and a powder of the metal modified hydroxyapatite.

Taoda et al. and Izawa have been relied on as discussed above in paragraph 8 relying on Dunn as the primary reference. Thus, to modify the combination and employ a silica alkoxide sol-gel process for coating a titanium modified hydroxyapatite powder to the surface of a container would have been obvious to the ordinarily skilled artisan as a conventional expedient for coating container and food contact surfaces, which provides protection against microorganisms as well as photo-degradation.

18. Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over the references as applied to claims 19 and 32 above in paragraph 16, and in further view of Izawa (JP2000-17456), for the reasons given above in paragraph 17 with respect to claims 26 and 27.

19. Claims 29 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over the references as applied above to claims 15, 17, 29 and 30 above in paragraph 14, relying on Wakamura '315 as the primary reference and in further view of Farnham (US 2531329) and Salvi (US 6632467).

Regarding claims 29 and 30, if applicants' intent was to store food without light, then it is noted that Farnham teaches storage of a food product in a container teaches storage when exposed to sunlight and storage in darkness to minimize the effect of ultraviolet light (see column 4, lines 54-60). Salvi further evidences this concept on column 16, lines 53-59). Therefore, to modify the combination and store the food without exposure to ultraviolet light would thus have been obvious to one having ordinary skill in the art, for the purpose of preventing ultraviolet radiation from resulting in contamination or spoilage of the product.

20. Claim 31 is rejected under 35 U.S.C. 103(a) as being unpatentable over the references as applied above to claims 18 and 31 above in paragraph 15, and in further view of Farnham (US 2531329) and Salvi (US 6632467), for the reasons given above with respect to claims 29 and 30 above in paragraph 19.

21. Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over the references as applied above to claims 19 and 32 above in paragraph 16, and in further view of Farnham (US 2531329) and Salvi (US 6632467), for the reasons given above with respect to claims 29 and 30 above in paragraph 19.

Response to Arguments

22. Applicants' arguments filed June 29, 2010 have been considered but are not persuasive to overcome the rejections under 35 U.S.C. 103(a).

23. Applicants assert on page 6 of the response that sintering titanium modified calcium hydroxyapatite at between 580-660°C achieves unexpected results in that the antibacterial effect has been enhanced due to this sintering, compared with non-sintered or otherwise sintered titanium modified calcium hydroxyapatite. It is pointed out that the claim recites that the result of sintering is "enhancing the photocatalytic activity " of the titanium modified calcium hydroxyapatite. This is evidenced on page 14, line 23 to page 15, line 3 of applicants' specification. Even further however, the references applied above provide motivation for heating a metal-modified calcium hydroxyapatite to within applicants' claimed range for the purpose of preventing the metal from dissolving out of the composition. Mawatari also teaches that the heating results in preventing the metal from dissolving out of the composition. Additionally, it is noted that Kato, Imura, Taoda et al. teach that the photocatalytic activity of titanium can

be increased by heating to 600°C, thus even teaching that applicants where not the first to enhance photocatalytic activity of the titanium by sintering to a temperature within 580-660°C.

24. Further on page 7 of the response, applicants assert that Mawatari only strengthens the bonding of silver on calcium hydroxyapatite at temperatures above applicants' claimed range. It is noted however, as discussed above, that Mawatari has only been relied on as further evidence that heating to prevent dissolution of a photocatalytic metal from the hydroxyapatite by heating the combination. In view of Saito, Kato, Imura and Tada et al., it is noted that the art reasonably leads one of ordinary skill in the art to employ temperature ranges within the claimed range, for the purpose of preventing photocatalytic metals from dissolving off of the surface of a hydroxyapatite and for enhancing photocatalytic activity.

25. Regarding applicants' arguments regarding Bontinck and the Sakurada references, it is noted that Bontinck has only been relied on to teach styrene based packages that can be used for packaging food. Mawatari teaches styrene based packaging comprising metal modified hydroxyapatite for providing antimicrobial protection. Similarly, Sakurada '667 and '210 have only been relied on as further evidence that it has been conventional to combine the photocatalytic activity as a result of using titanium with the absorptive properties of calcium hydroxyapatite for the purpose of providing antimicrobial food packaging.

26. In view of the teachings disclosed in the formal translation the reference to Shimazaki et al. has been further relied on as evidence of partial substitution of calcium hydroxyapatite with metals and heat treatment within applicants' claimed range.

27. On page 8 of the response, applicants assert that Saito only enumerates metals such as Ag, Cu, Zn, Sn, Hg, Pb and Cd, as examples of acceptable antimicrobial metals and does not disclose titanium. It is noted however, that both Wakamura '315 and Saito teach common metals such as zinc. Saito is further related in that Saito employs a metal for providing "antimicrobial properties." Thus Saito does indeed provide motivation for heating to within applicants' claimed range, for the purpose of preventing the metal from dissolving out of the composition. In any case, Kato, Imura and Taoda et al. provide further evidence of the increase in photocatalytic activity of titanium by heating to within applicants' claimed range, for the purpose of providing photocatalytic activity.

28. Applicants further urge on page 8 as to how sintering temperatures of a metal modified hydroxyapatite at a temperature of 600°C, for instance, wherein the metal is not titanium would have made it obvious to have sintered titanium modified calcium hydroxyapatite. It is noted however, that Saito is clearly related to those metal/hydroxyapatite combinations taught by Wakamura '315, since Saito relies on the metal and the hydroxyapatite for providing additive antimicrobial protection. It is noted

that Wakamura '315 is performing the same function of providing additive antimicrobial protection by modifying hydroxyapatite with titanium. The only difference is the particular photocatalytic/antimicrobial metal in combination with the hydroxyapatite. But since Wakamura '315 teaches that the metal can also be zinc, which Saito also teaches, the art fairly leads one of ordinary skill in the art to also heat a titanium modified calcium hydroxyapatite within the same temperature range for the purpose of preventing the titanium from dissolving out. It is further noted that applicants claims do not specify how the photocatalytic activity has been enhanced, or compared to what has this photocatalytic activity been increased. For instance, preventing the titanium from dissolving out after drying would also appear to enhance photocatalytic activity, since the titanium would still have been available for treatment of the food. As such, by providing motivation for heating to 600°C, the result would also have been increased photocatalytic activity. Nevertheless, the advantages of heating to temperatures within applicants' claimed range has further been supported by the references to Kato, Imura and Taoda et al., who teach that if the photocatalytic activity was desired to be increased then to heat the titanium to temperatures such as 600°C. Since the titanium modified calcium hydroxyapatite provides the function of the titanium and the function of the hydroxyapatite, to thus sinter the combination at 600°C when the art already teaches heating a combination comprising titanium for increasing the photocatalytic activity of titanium would thus have been obvious to one having ordinary skill in the art, for its art recognized function of increasing photocatalytic activity of the titanium.

29. The reference to Hirade has been withdrawn in view of the rejections above which address applicants claimed heating step.

30. On page 9 of the response, applicants assert that Shimazaki fails to teach titanium modified calcium hydroxyapatite that has been sintered to within the claimed range. This urging has been considered but is not persuasive, since Shimazaki teaches that one of the metals that can be employed for partial substitution can be titanium and that the combination can be subsequently heated to temperatures within the claimed range, for the purpose of improving the catalytic activity of the combination.

31. On page 10 of the response, applicants assert that Sakuma only enumerates Ag, Zn and Cu as examples of antibacterial metals and only sinters at a temperature of 800°C. It is noted however, that Sakuma has been relied on in this office action to teach application of a metal modified hydroxyapatite directly to a product that could be ingested and has been relied on for this purpose. Although Sakuma teaches temperatures above applicants' claimed range, the references taken as a whole, teach temperatures below, within and above applicants' range for the purpose of enhancing photocatalytic activity as well as for preventing the metal from dissolving out of the combination.

32. The references to Atsumi have been withdrawn as being duplicative of teachings already presented above, and thus have been withdrawn.

33. Regarding Okamoto, this reference has only been relied on to teach that "tableware" can be coated with photocatalytic material for protecting against bacterial and photo-degradation.
34. Regarding applicants' urgings on pages 10-12 of the art teaching high temperature sintering, it is noted that these arguments are not persuasive in view of the teachings of Saito, Kato, Imura and Taoda et al., as discussed above.
35. On page 12 of the response, applicants assert that Saito and Hirade cannot be combined with Mawatari, Sakuma or either Atsumi references. It is noted that the Atsumi references have been withdrawn, as has Hirade.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to VIREN THAKUR whose telephone number is (571)272-6694. The examiner can normally be reached on Monday through Friday from 8:00 am - 4:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Rena Dye can be reached on (571)-272-3186. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/Viren Thakur/
Examiner, Art Unit 1782